

**Design:**

**Site Data Collection**

**Template**

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<https://energypedia.info/wiki/Toolbox_on_SPIS>

About

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# DESIGN – Site data collection template

## Introduction

This tool helps with the on-site collection of data required to design an SPIS and to assess its general viability. It is particularly relevant for the module **DESIGN**, **MAINTAIN** and **SAFEGUARD WATER** of the SPIS toolbox.

## OVERVIEW

This template comprises the following steps:

1. General Information: For basic location and meteorological data for the site.
2. Water Supply Situation: For specifying water source and access related information. This checklist is complemented by a checklist tool in: **SAFEGUARD WATER – Water Resource Management Tool**.
3. Energy Supply Situation: for specifying energy source and access related information.
4. Agricultural Production: for specifying site conditions and type and extent of agricultural production a calculation tool in complements this checklist: **IRRIGATE – Soil Tool**.
5. Water Pumping Technology: This checklist is complemented by a calculation tool in: **DESIGN – Pump Sizing Tool**.
6. Irrigation Technology: For specifying irrigation and fertigation mechanism used.
7. Management Requirements: For specifying general management related aspects.
8. Financial Assessment: This checklist is complemented by a calculation tool in: **INVEST – Payback Tool** & **INVEST – Farm Analysis Tool**.
9. Ecological Impacts: For specifying environmental impact observations this checklist is complemented by a checklist tool in: **SAFEGUARD WATER – Water Resource Management Tool.**
10. Training and Acceptance: For specifying the extent of training and skills development measures.

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# GENERAL INFORMATION

**GPX DATA:**

**Country:**        **Owner:**

**Farm:**       **Interviewer:**

**District:**       **Region:**       **Date:**

## General information

**History of the system/farm (ownership, previous irrigation practices, others)**

## Geographical Position

**Latitude [°]**

**Longitude [°]**

**Altitude [m]**

## Climatic Conditions

Humid  Arid  Others

Semi-humid  Semi-arid

Remarks

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Unit** | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |
| **Insolation / hor.** | *[kWh/m²d]* |  |  |  |  |  |  |  |  |  |  |  |  |
| **Min. Temp.** | *[°C]* |  |  |  |  |  |  |  |  |  |  |  |  |
| **Max. Temp.** | *[°C]* |  |  |  |  |  |  |  |  |  |  |  |  |
| **Mean Temp.** | *[°C]* |  |  |  |  |  |  |  |  |  |  |  |  |
| **Rainfall** | *mm* |  |  |  |  |  |  |  |  |  |  |  |  |
| **ETo** | *mm* |  |  |  |  |  |  |  |  |  |  |  |  |

Remarks

# Water supply situation

## Water source

Well  Pond  Lake  Canal

Diameter       m Others

Remarks

## Water Quality

Normal  Brackish (salty)  Hard (high lime content)  Others

Salinity       μS Temperature       °C

Remarks*(e.g. Minerals, Bacteria, Special Silt and Clay)*

## Water Availability

Sufficient  Seasonal  Scarce  Others

Remarks*(e.g. Existing Regulations / Allocations)*

## Water Ownership

Private  Public  Association  Others

Remarks

# Energy Supply Situation

## Public Grid supply

**Grid connection** Yes  No  Grid Voltage [V]

**Grid availability** 24/7  hrs/day

Remarks*(e.g. blackout frequency)*

## Off-grid Supply

Diesel Generator  Gas Generator  PV Generator

Hybrid  Others

Remarks*(e.g. type of generator)*

**Conventional Generator**

**Manufacturer**

**Purpose** Main Supply  Back-up Supply

**Model**

**Rated Power [kW]**       **Frequency [Hz]**

**Fuel Type**        **Fuel Consumption [l/d]**

Remarks*(e.g. type of generator)*

# agricultural production

## terrain

Flat  Wadi (dry riverbed)  Hilly  Valley

Slope       % Others

Remarks

## soil type

Clay  Silt  Sand  Variations

Type       Others

Remarks*(e.g. water holding capacity)*

## soil salinity

Low  Medium  High  Others

pH-value       Organic Matter Content       %

Remarks

## cash crop type

Vegetables  Cereals  Tree Crops  Flowers

Others       Others

Remarks

## crop rotation

Number of crops per year       Fallow period (no crops planted)       days

Crop 1 (type and duration)             days per year

Crop 2 (type and duration)             days per year

Crop 3 (type and duration)             days per year

Crop 4 (type and duration)             days per year

Crop 5 (type and duration)             days per year

## IRRIGATION DEMAND

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Water Demand [m³/d]** | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |
| **Crop 1** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Crop 2** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Crop 3** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Crop 4** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Crop 5** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Total Demand** |  |  |  |  |  |  |  |  |  |  |  |  |

## livestock type

Cattle  Goats  Sheep  Wildlife

Others       Others

## livestock quantity

Livestock 1 (type and quantity)             head per year

Livestock 2 (type and quantity)             head per year

Livestock 3 (type and quantity)             head per year

Livestock 4 (type and quantity)             head per year

Livestock 5 (type and quantity)             head per year

## LIVESTOCK WATER DEMAND

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Water Demand [m³/d]** | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |
| Livestock 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| Livestock 2 |  |  |  |  |  |  |  |  |  |  |  |  |
| Livestock 3 |  |  |  |  |  |  |  |  |  |  |  |  |
| Livestock 4 |  |  |  |  |  |  |  |  |  |  |  |  |
| Livestock 5 |  |  |  |  |  |  |  |  |  |  |  |  |
| Total Demand |  |  |  |  |  |  |  |  |  |  |  |  |

# wATER PUMPING TECHNOLOGY

## CONVENTIONAL WATER PUMP

**Pump Type** Surface Pump  Submersible Pump

Positive Displacement  Centrifugal  Others

Manufacturer

Model

*Max. Head*       *m* *Max. Flow Rate*       *m³/h*

*Operating Time*       *h/d*

Remarks*(e.g. installation depth)*

## PHOTOVOLTAIC PUMPING SYSTEM

**Solar Cell Type** Si-poly  Si-mono

Thin-film  Others

**Solar Generator**

Manufacturer

Model

*Module Nom. Power*       *Wp* *Modules in Series*

*Generator Nom. Power*       *kWp Strings in Parallel*

*Tilt Angle*       ° *Tilt Angle*       °

*Shading*

Remarks

**Mounting System** Fixed South/North  Tracking

Fixed West/East  Others

Manufacturer

Model

Mounting Type

Remarks*(e.g. single or double axis tracking)*

**Controller/Inverter**

**Manufacturer**

**Model**

*Nominal Power*       *kW*  *Number of Controllers*

*Input Voltage max.*       *V Total Power*       *kW AC*

Remarks

**Pump Unit**

**Manufacturer**

**Model**

*Maximum Head*       m *Max. Flow Rate*       *m³/d*

*Max. Flow per day*        *m³/d Total Pump Volume*       *m³/a*

Remarks

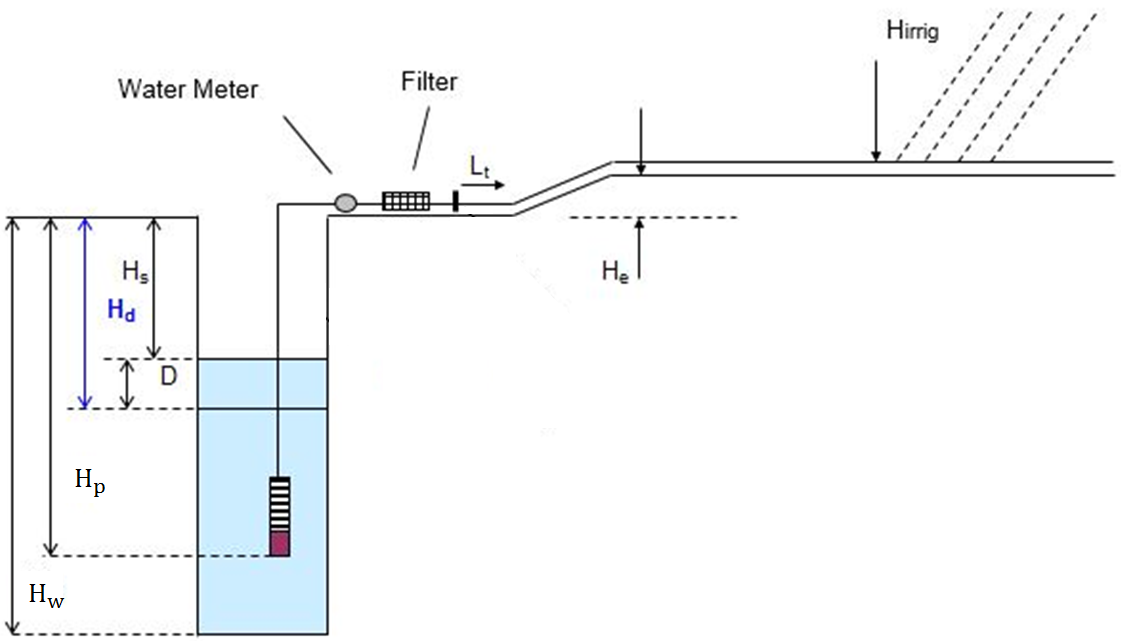
## determination of pumping head

*This checklist is complemented by a calculation tool in* **DESIGN - Pump Sizing Tool.**

|  |  |  |  |
| --- | --- | --- | --- |
| Hg | Geodetic Pumping Head |  | **m** |
| Hs | Static Water Level |  | **m** |
| D | Drawdown |  | **m** |
| Hd | Dynamic Water Level |  | **m** |
| Hp | Depth of Pump Intake |  | **m** |
| Hw | Depth of Well |  | **m** |
| He | Elevation Difference Well/Tank |  | **m** |
| Ht | Height of Tank Inlet |  | **m** |
| dw | Diameter of Well Casing |  | **mm** |
| dr | Diameter of Riser Pipe |  | **mm/inch** |
| dp | Diameter of Transmission Pipe |  | **mm/inch** |
| lp | Length of Transmission Pipe |  | **m** |
| V | Volume of Water Tank |  | **m3** |
| Hl | Head Loss in Pipeline |  | **m** |
| Hm | Head Loss in Water Meter |  | **m** |
| Hf | Head Loss in Filter/Fertigation |  | **m** |
| Hirrig | Pressure Irrigation System |  | **m** |

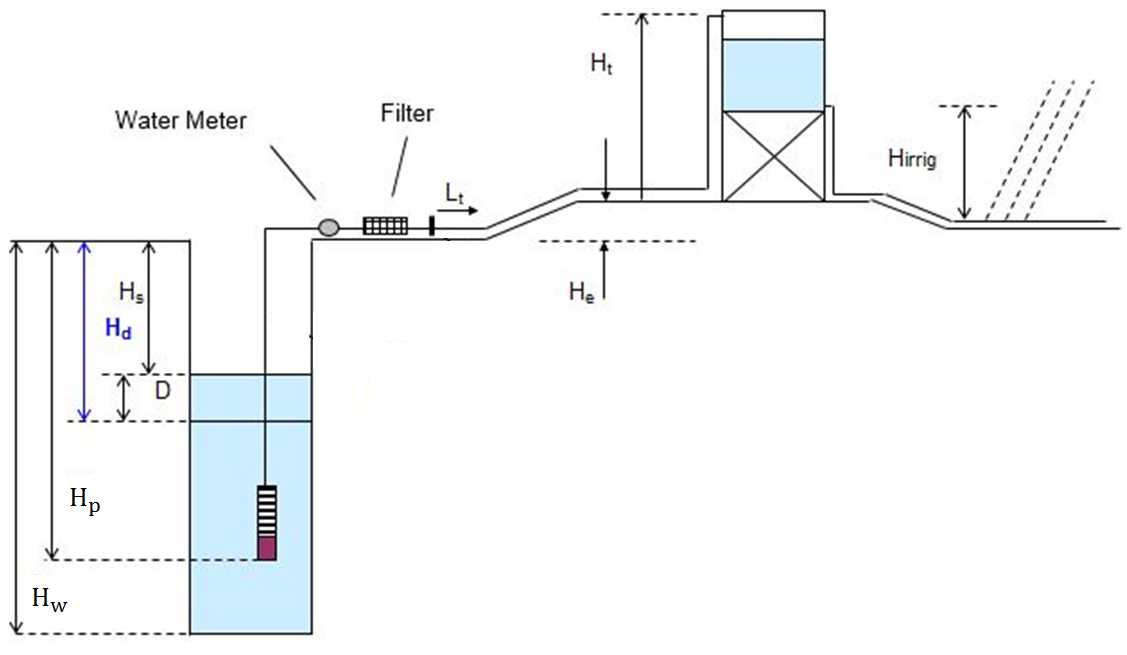
**Direct feed in**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Htotal** | **=** | **Hs + D + He + Hm + Hf + Hl + Hirrig** | **=** |  | ***m*** |



|  |  |  |  |
| --- | --- | --- | --- |
| Hg | Geodetic Pumping Head |  | **m** |
| Hs | Static Water Level |  | **m** |
| D | Drawdown |  | **m** |
| Hd | Dynamic Water Level |  | **m** |
| Hp | Depth of Pump Intake |  | **m** |
| Hw | Depth of Well |  | **m** |
| He | Elevation Difference Well/Tank |  | **m** |
| Ht | Height of Tank Inlet |  | **m** |
| dw | Diameter of Well Casing |  | **mm** |
| dr | Diameter of Riser Pipe |  | **mm/inch** |
| dp | Diameter of Transmission Pipe |  | **mm/inch** |
| lp | Length of Transmission Pipe |  | **m** |
| V | Volume of Water Tank |  | **m3** |
| Hl | Head Loss in Pipeline |  | **m** |
| Hm | Head Loss in Water Meter |  | **m** |
| Hf | Head Loss in Filter/Fertigation |  | **m** |
| Hirrig | Pressure Irrigation System |  | **m** |

**Tank system**



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Htotal** | **=** | **Hs + D + He + Ht + Hm + Hf + Hl** | **=** |  | ***m*** |

# IRRIGATION TECHNOLOGY

## IRRIGATED AREA

Number of Plots/Sub-Fields:       Size of Plots/Sub-Fields:       *ha*

      *ha*

      *ha*

Remarks

## FEED PIPE

Material

Diameter      *mm* Length      *mm*

Remarks

## WATER DISTRIBUTION SYSTEM

Gravity System  Pressurized System

Drip  Mini-Sprinkler  Center Pivot

Others

Manufacturer

Model

*Nominal Pressure*       *m*  *Operating Pressure*       m

*Nominal Flow*        *l/h Distribution Uniformity*       *%*

Remarks*(e.g. clogging sensitivity, water losses)*

## FILTER SYSTEMS

Fins  Granulate  Sand  Others

Manufacturer

Model

*Manual Backwashing*  *Automatic Backwashing*

*Nominal Pressure*       *m*  *Operating Pressure*       m

*Other Information*      

Remarks

## FERTIGATION/CHEMIGATION

**Fertilizer/Pesticide Application**

Manually  Pressurized Differential Tank  Bladder Tank

Dosing Pump  Venturi Nozzle  Others

Manufacturer

Model

Power Supply

*Power Consumption*       *W*

*Nominal Pressure*       *m Operating Pressure*       *m*

*Other Information*      

Remarks

## monitoring

Soil Moisture       Flow Rates       Pressure

Temperature       Rainfall       Others

Manufacturer

Model

Remarks

# management requirements

## players in farm management

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Internal Players** | **Helpful** | **Not Present** | **Missing** | **Do not Know** |
| Farm Owner |  |  |  |  |
| Facility Manager |  |  |  |  |
| Foreman |  |  |  |  |
| Field Workers |  |  |  |  |
| Others |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Internal Players** | **Helpful** | **Not Present** | **Missing** | **Do not Know** |
| Water Authority |  |  |  |  |
| Association |  |  |  |  |
| Agricultural Advisors |  |  |  |  |
| Agricultural suppliers |  |  |  |  |
| Financial advisors |  |  |  |  |
| Others |  |  |  |  |

Remarks

## STRATEGIC MANAGEMENT (horizon: >5-20 years)

**How did you hear about SPIS / Source of Information?**

Agricutlural advisory services  Internet  Radio/television

Agricultural supplier  Neighbor/friend  Financial advisory services

**What was the reason to switch from conventional to photovoltaic energy supply?**

Weak or not existing grid power  Subsidy cuts for conventional fuel

Problems with fuel supply  Lower technical reliability of convent. System

Problems with spare parts supply  Lower cost of solar system

Environmentally sound technology  Positive (green) image

Protection of ground water level and quality

Remarks

**Could you purchase all components of the SPIS locally?**

Yes No

Remarks

**Which component needed to be imported by you?**

Solar panels  Mounting system  Pump/controller

Fertigation system  Irrigation system

Remarks

**Did the change from conventional to photovoltaic energy require a change of the irrigation technology?**

Yes No

Remarks

**How many years of experience do you have with conventional water pumping?**

Number of years of experience:

Remarks

**How many years of experience do you have with photovoltaic water pumping?**

Number of years of experience:

Remarks

**How was the system financed?**

Own equity  Standard Bank loan  Agricultural credit  Others

Remarks

**If financing was applied**

Interest rate       % Payback time       years

**Would you invest again in a SPIS?**

Yes  No

Remarks

## TACTICAL MANAGEMENT (HORIZON <1 year)

**What was the reason for choosing the crops mentioned under 4.4?**

High market demand  Pest resistant

High market price  Other

Low water demand  Other

Remarks

**Are sufficient farm workers available during planting and harvesting season?**

Yes  No

Remarks

**How would you assess the technical knowledge of your farm workers?**

Low  Medium  High

Excellent  Other

Remarks

**Have you ever experienced problems in fuel and spare parts supply of the conventional pumping system?**

Yes  No

Remarks

**Have you ever experienced problems in spare parts supply of the photovoltaic pumping system?**

Yes  No

Remarks

**How would you assess the technical reliability of a conventional pumping system?**

Low  Medium  High

Excellent  Other

Remarks

**How would you assess the technical reliability of a solar pumping system?**

Low  Medium  High

Excellent  Other

Remarks

**Regarding SPIS, what needs to be technically improved from your point of view?**

Remarks

**Have you ever experienced problems in water availability and supply?**

Yes  No

Remarks

**If yes, what were the reasons for the water shortage?**

Remarks

**Do you have easy market access to sell your products?**

Yes  No

Remarks

**How would you assess the logistical efforts to bring the products to the market?**

Low  Medium  Difficult

Other

Remarks

**Did you notice any other challenges in tactical farm management?**

Remarks

## OPERATIONAL MANAGEMENT (horizon: 1 day)

**Who is operating your SPIS?**

Foreman  Farm worker  Other

Remarks

**How is the SPIS being controlled?**

Automatic Operation  Manual  Semi-Automatic

Remarks

**How do you determine the daily water demand of the plants?**

ETo calculation  Estimation  Experience

Software  Other

Remarks

**If you have several sub-fields, what is your irrigation technique?**

Volume control  Time control  Others

Remarks

**Do you suffer from any water losses in the system?**

Yes No

Remarks

**If yes, what do you do in order to avoid water losses?**

Remarks

**What are the cleaning intervals of filters?**

Remarks

**Do you know about the pressure losses caused by clogged filters?**

Yes No

Remarks

**How do you determine the fertilizer demand of the plants?**

Calculation  Estimation  Experience

Software  **Others**

Remarks

**What are the fertigation intervals?**

Low  Medium  High

Other

Remarks

**How would you assess the daily maintenance requirements of a conventional pumping system?**

Low  Medium  High

Other

Remarks

**How would you assess the daily maintenance requirements of a conventional pumping system?**

Low  Medium  High

Other

Remarks

# finANCIAL ASSESSMENT

## INVESTMENT AND OPERATION COSTS

Costs Pump Equipment       Year of purchase / installation

Costs Distribution System       Year of purchase / installation

Annual maintenance costs

External Service Provider for O & M       Company

**Operational Costs Categories**

|  |  |  |
| --- | --- | --- |
| **Type** | **Cost** | **Frequency** *(per month / per year?)* |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## financial strategy

**Loan for Pump Equipment**

Yes No

*(Amount, Interest, Duration, etc.)*

**Loan for Distribution System**

Yes No

*(Amount, Interest, Duration, etc.)*

**Loan for Storage / Filter System**

Yes No

*(Amount, Interest, Duration, etc.)*

**Loan for O&M**

Yes No

*(Amount, Interest, Duration, etc.)*

**Depreciation of Capital Costs**

Yes No

*(Amount, Interest, Duration, etc.)*

**Subsidies**

Yes No

*(Amount, Duration, etc.)*

## labor requirements

Farm Labor Requirements

Crop 1 (w/d, EUR per w/d)

Crop 2 (w/d, EUR per w/d)

Crop 3 (w/d, EUR per w/d)

Crop 4 (w/d, EUR per w/d)

Crop 5 (w/d, EUR per w/d)

Irrigation (w/d, EUR per w/d)

Others (w/d, EUR per w/d)

## Fees, Duties & Charges

Water Tariff (EUR/m³)

Electricity Tariff (EUR/kWh)

Diesel Price (EUR/l)

Other Charges & Duties (EUR)

## Agricultural production & Revenue

**Crop 1**

Crop Type       Area (ha)

Production (kg)       Sales (kg)

Land Preparation (EUR)

Input Seeds / Fertilizer (EUR)

Input Plant Protection (EUR)

Harvest (EUR)

Transport / Storage (EUR)

Irrigation System Quantity

Pumping Hours

Other Costs (w/d, EUR per w/d)

Market Price Produce (EUR / kg)

**Crop 2**

Crop Type       Area (ha)

Production (kg)       Sales (kg)

Land Preparation (EUR)

Input Seeds / Fertilizer (EUR)

Input Plant Protection (EUR)

Harvest (EUR)

Transport / Storage (EUR)

Irrigation System Quantity

Pumping Hours

Other Costs (w/d, EUR per w/d)

Market Price Produce (EUR / kg)

**Crop 3**

Crop Type       Area (ha)

Production (kg)       Sales (kg)

Land Preparation (EUR)

Input Seeds / Fertilizer (EUR)

Input Plant Protection (EUR)

Harvest (EUR)

Transport / Storage (EUR)

Irrigation System Quantity

Pumping Hours

Other Costs (w/d, EUR per w/d)

Market Price Produce (EUR / kg)

**Crop 4**

Crop Type       Area (ha)

Production (kg)       Sales (kg)

Land Preparation (EUR)

Input Seeds / Fertilizer (EUR)

Input Plant Protection (EUR)

Harvest (EUR)

Transport / Storage (EUR)

Irrigation System Quantity

Pumping Hours

Other Costs (w/d, EUR per w/d)

Market Price Produce (EUR / kg)

**Crop 5**

Crop Type       Area (ha)

Production (kg)       Sales (kg)

Land Preparation (EUR)

Input Seeds / Fertilizer (EUR)

Input Plant Protection (EUR)

Harvest (EUR)

Transport / Storage (EUR)

Irrigation System Quantity

Pumping Hours

Other Costs (w/d, EUR per w/d)

Market Price Produce (EUR / kg)

# ecological impacts

**Do you suffer from salting of soil?**

Yes No

Remarks

**Which measures do you take to avoid salting of soil?**

Remarks

**How do you see the development of your groundwater resources?**

Water resource is very reliable and stable

Water resource is often interrupted

Water resource fluctuates seasonally

Water availability depends on other people

Remarks

**How do you see the development of your groundwater resources in surrounding area?**

Many other pumps already operate

No control in pumping system development

Many new pumping systems planned

Regular conflict with neighbours

Remarks

**Do you observe a groundwater level variation?**

Yes, but only at my own water source

Yes, water levels in area have declined over years

Yes, many dying trees in the area

No impacts detected

Remarks

**What is the maximum draw down of the water level during pumping?**

Drawdown (m)

Remarks

**What do you do to avoid over-pumping of aquifers?**

Remarks

**Do you see a difference in water quality after installing an SPIS?**

Yes No

Remarks *(e.g. by avoiding leakages of oil and lubricants)*

**Do you see a difference in water availability after installing an SPIS?**

Yes No

Remarks

**Do you see a difference in soil quality after installing an SPIS?**

Yes No

Remarks*(e.g. by avoiding leakages of oil and lubricants)*

**Are there any other environmental benefits you would like to mention?**

Yes No

Remarks

# training and acceptance

**Do you have an operational manual / training manual for your employees?**

Yes No

Remarks

**Do you get regular support from agricultural advisory services? What kind?**

Yes No

Remarks

**Do you have a specific need for training?**

Yes No

Remarks

**Could you please specify the need for training?**

Remarks

**Have you ever experienced acceptance problems from farm managers, facility managers or farm workers regarding SPIS?**

Yes No

Remarks

**If yes, what kind of acceptance problems have you experienced?**

Remarks

**How do you see the role of local / regional authorities in your region / country?**

Remarks

**Do you usually employ women on the farm?**

Yes No

Remarks

**Does the use of an SPIS have an influence on the number and gender of field workers and/or other staff members?**

Yes No

Remarks